

Fully Funded PhD Studentship (DEL)

## Game Theoretic Models of Cooperative Vehicular Networks for Intelligent Transport Systems

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<http://www.relationaleconomy.net/>

### Specification:

Increasing numbers of road users, congestion, rising fuel and road tax costs will mean that a new generation of Intelligent Transportation Systems (ITS) are required which will improve road safety, traffic management and introduce a fair pricing for road usage. Recent years have already seen significant interest generated towards the study of vehicle-to-vehicle (V2V) and Vehicle-to-Roadside (V2R) communications, e.g. dedicated short-range communications (DSRC) for use in Intelligent Transportation Systems. Due to the vast number of road users and the dynamic nature of road traffic, the topology of these networks can change dramatically in short spaces of time, meaning that they are extremely complex to set up and manage. An example of this type of scenario is depicted in Fig.1 where a road traffic accident has just occurred. A V2V mobile ad hoc network is set up between co-located vehicles in the immediate vicinity to warn other road users of the incident and to suggest that motorists follow alternative routes. V2R communications are also used to monitor traffic volumes and adaptively adjust signals to avoid congestion. This unique type of ad hoc networking problem will benefit from the use of advanced mathematical tools such as game theoretic modelling. When game theory is applied to ad hoc networks, nodes are considered decision makers whose payoffs depend on other nodes' actions.

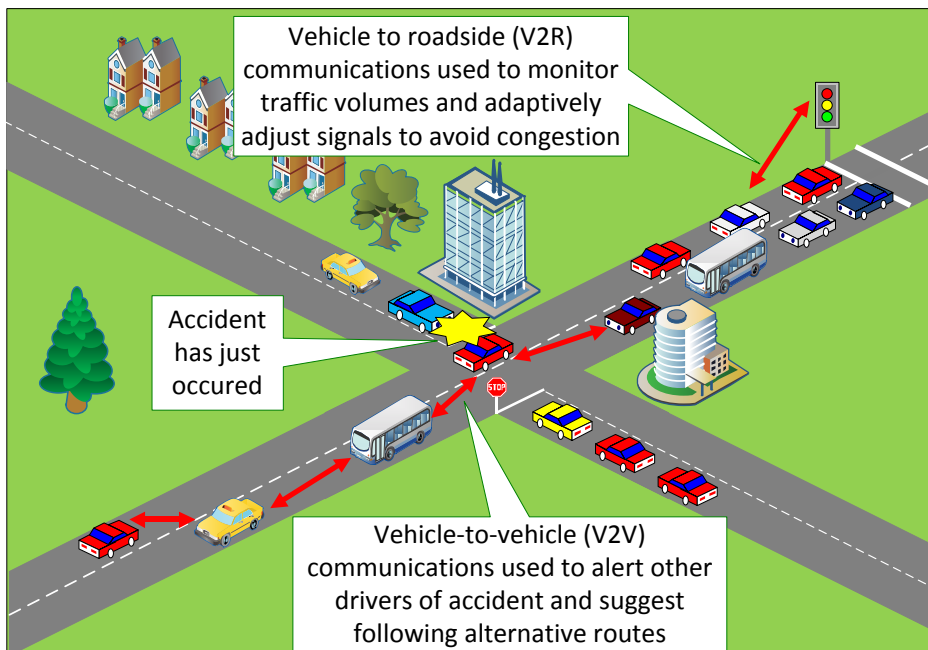


Fig. 1 Illustration of V2V and V2R communications following a road traffic accident.

One of the key challenges in improving the accuracy of game theoretic models when applied to physical layer communications in ad hoc networks is the modelling of the wireless channel. Due to the time-variant nature and complex propagation mechanisms associated with signal transmission in vehicular networks this will often involve a non-linear mathematical analysis. Combining accurate channel models with game theory will provide network designers with the tools required to optimise protocols and efficiently manage radio resources in cooperative V2V and V2R networks. This will be critical to achieving the goal of “Green Transport” where travel and route information must be relayed rapidly to road users to adaptively re-route and adjust the speed of traffic flow to avoid congestion, in the process reducing fuel consumption and carbon emissions.

This project will leverage the extensive knowledge of the Digital Communications Cluster, EECS, and the Economic Analysis and Behaviour Cluster, Management School to develop a comprehensive set of V2V and V2R channel models which optimise current game theory models, used for ad hoc networks, for road traffic and road side information exchange. The project will provide a high level of postgraduate training in the areas of wireless communications, Intelligent Transportation Systems and game theory.

The project is associated with the Electronics, Communications and Information Technology Institute (ECIT – see [www.csit.qub.ac.uk](http://www.csit.qub.ac.uk)) and the QUB Management School (<http://www.qub.ac.uk/mgt/>). It will be based within the Wireless Communications Research Group ([www.ee.qub.ac.uk/wireless/](http://www.ee.qub.ac.uk/wireless/)) at ECIT.

#### **MORE INFORMATION**

Applicants should apply electronically through the Queen's online application portal at <https://pg.apply.qub.ac.uk/home> by **31 July 2011**.

For further information on the technical and academic aspects of the project contact [simon.cotton@qub.ac.uk](mailto:simon.cotton@qub.ac.uk)

Further information on the studentship, eligibility and conditions available at: <http://www.qub.ac.uk/schools/eeecs/ProspectiveStudents/Scholarships/PostgraduateResearchScholarships>